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LISTS OF SPECIES

Fish, lower Ivinhema River basin streams, state of Mato Grosso do Sul, Brazil.

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Abstract: The Ivinhema River basin is one of the main tributaries of the western portion of Paraná River. However, few data are available on the fish communities of its streams. Monthly samples were made in seven streams of the lower portion of the basin, in the state of Mato Grosso do Sul, using a rectangular sieve 1.2 x 0.8 m, with 2 mm mesh size. Forty-six fish species were found in these streams. The richness estimated according to the bootstrap procedure was 50 species. At least two of the captured species were not previously recorded for the upper Paraná basin, indicating the need of new sampling effort in this region.

Introduction

The Neotropical region has an extremely diverse fish fauna, including approximately 6,000 of the 13,000 freshwater fishes of the world (more than 46 %). However, much of this region remains unstudied (Reis et al. 2003).

Despite the increase in ecological studies on fish communities in the upper Paraná River basin, this information has been concentrated in a few parts of this large area. The majority of the studies have been done in the states of São Paulo and Paraná. Several studies have been carried out recently in western São Paulo and Paraná, in the lower stretches of the Grande, Paranapanema, and Tietê rivers (Castro et al. 2003; 2004; 2005; Casatti 2005; Casatti et al. 2006; Perez-Júnior and Garavello 2007) and in the Floodplain streams of the state of Paraná (Abes and Agostinho 2001; Pavanelli and Caramaschi 2003). Another recent study listed fish species in tributaries of the Paranapanema River in the state of Paraná (Shibatta et al. 2007). In an important study in the upper Paraná basin, Langeani et al. (2007) cited 310 species, with approximately 50 additional undescribed forms, reinforcing the necessity of increase the number of studies to obtain data from others portions of the Paraná basin.

The Ivinhema River basin is the main tributary of the Paraná River, in the western part of its basin in the state of Mato Grosso do Sul. However, few studies on the fish communities of this basin have been published, except those of Súarez et al. (2007a; b) and Valério et al. (2007), both carried out in headwater regions. In the context of increasing deforestation for agriculture and ranching, systematic and ecological studies of the fish communities are essential to understand and minimize the impact of this human alteration on the local aquatic communities. Herein, we present a checklist of the fish fauna from streams of two tributaries of the lower Ivinhema River basin (upper Paraná River basin) in the state of Mato Grosso do Sul, Brazil.

Material and Methods

Monthly samples were carried out from January to December 2002 in seven streams of the Ivinhema River basin (Figure 1). The sampling sites were selected in two small basins, tributaries of the Ivinhema River: Piravevê sub-basin (*córrego* Piravevê, *córrego* Azul, and *córrego* Da Mata) and Vitória sub-basin (*córrego* Vitória, *córrego* da Antonia, *córrego* Rosário, and *córrego* Libório). Only one of the streams had riparian vegetation (Antonia Stream), and the others drained mainly pastureland areas. Despite this, no domestic or industrial effluents were observed, and the water quality was apparently not much degraded.

The samples were taken during daylight, with a rectangular sieve 1.2 x 0.8 m (2 mm mesh size) and standardized effort (20 throws) at each site, with approximately 50 m long hauls. License for fish collection was granted IBAMA (#13458-1). Collections were not conducted at Da Mata Stream in January.

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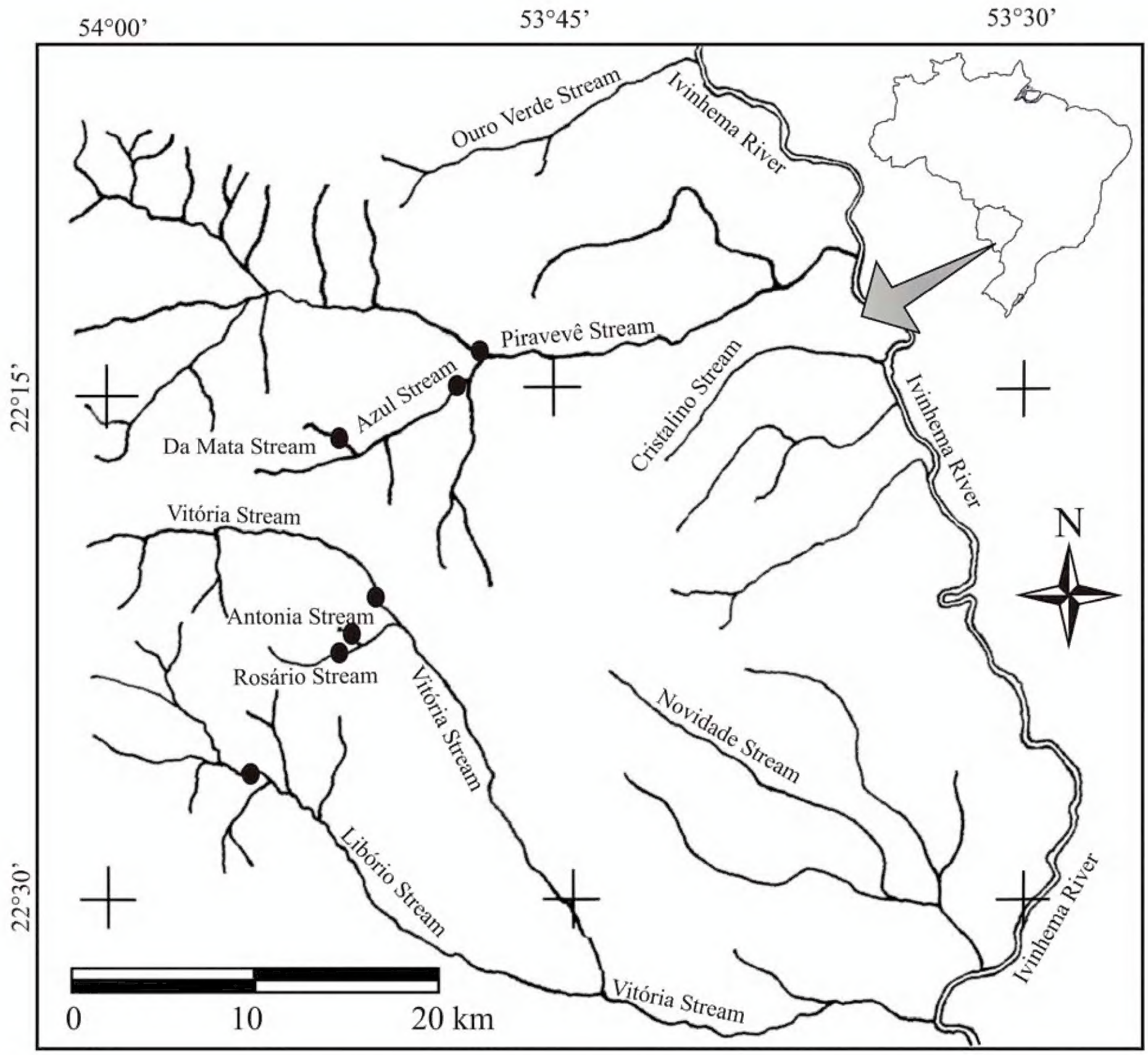

Figure 1. Sampled areas in Ivinhema River basin, Mato Grosso do Sul, Brazil.

Specimens were fixed in 10 % formalin and preserved in 70 % ethanol. Identifications followed Britski et al. (1999) and Graça and Pavanelli (2007), as well as specific keys for each taxonomic group.

In some cases the collected specimens were compared with type material held at the *Museu de Zoologia da Universidade de São Paulo* (MZUSP). Voucher specimens were deposited in the Zoologic Collection of the *Universidade Estadual de Mato Grosso do Sul* (*Unidade de Ivinhema*), Ichthyologic Collection of the *Centro Integrado de Análise e Monitoramento Ambiental* (CInAM/*Laboratório de Ecologia*), and in the MZUSP. The taxonomic placement of the collected species was defined according to Reis et al. (2003) and Graça and Pavanelli (2007).

Bootstrap procedure (Efron 1979) was used to estimate total species richness for the sampled streams (Smith and Van Belle 1984), as well as its confidence interval ($\alpha = 0.05$), using presence/absence data for all samples. This procedure was selected for its robustness with relatively great samples sizes (Hellmann and Fowler 1999).

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Results and Discussion

A total of 3,383 individuals were caught, belonging to 46 species (Table 1). The estimated richness for the sampled streams was 50 species, with a confidence interval from 49 to 51 (Figure 2). Characiformes was the predominant order, with 25 species (54.3 %), followed by Siluriformes with 13 species (28.3 %). These proportions are similar to other fish assemblages in Neotropical basins and specifically in the upper Paraná Basin (Castro 1999; Langeani et al. 2007).

The most common species was *Serrapinnus notomelas* (Eigenmann, 1915), present in 69.9 % of the samples, followed by *Hemigrammus marginatus* Ellis, 1911, with 49.4 %, and *Hypostomus ancistroides* (Ihering, 1911) with 48.2 %. The common occurrence of *S. notomelas* and *H. marginatus* may be a result of the location of the streams in lower portions of the Ivinhema Basin, with slower water speed (floodplain streams). Water flux is a determinant factor for species occurrence (Súarez et al. 2007b), and these species are widely distributed in upper Paraná Basin streams (Pavanelli and Caramaschi 2003; Langeani et al. 2005; Valério et al. 2007; Perez-Júnior and Garavello 2007; Shibatta and Silva-Souza 2008).

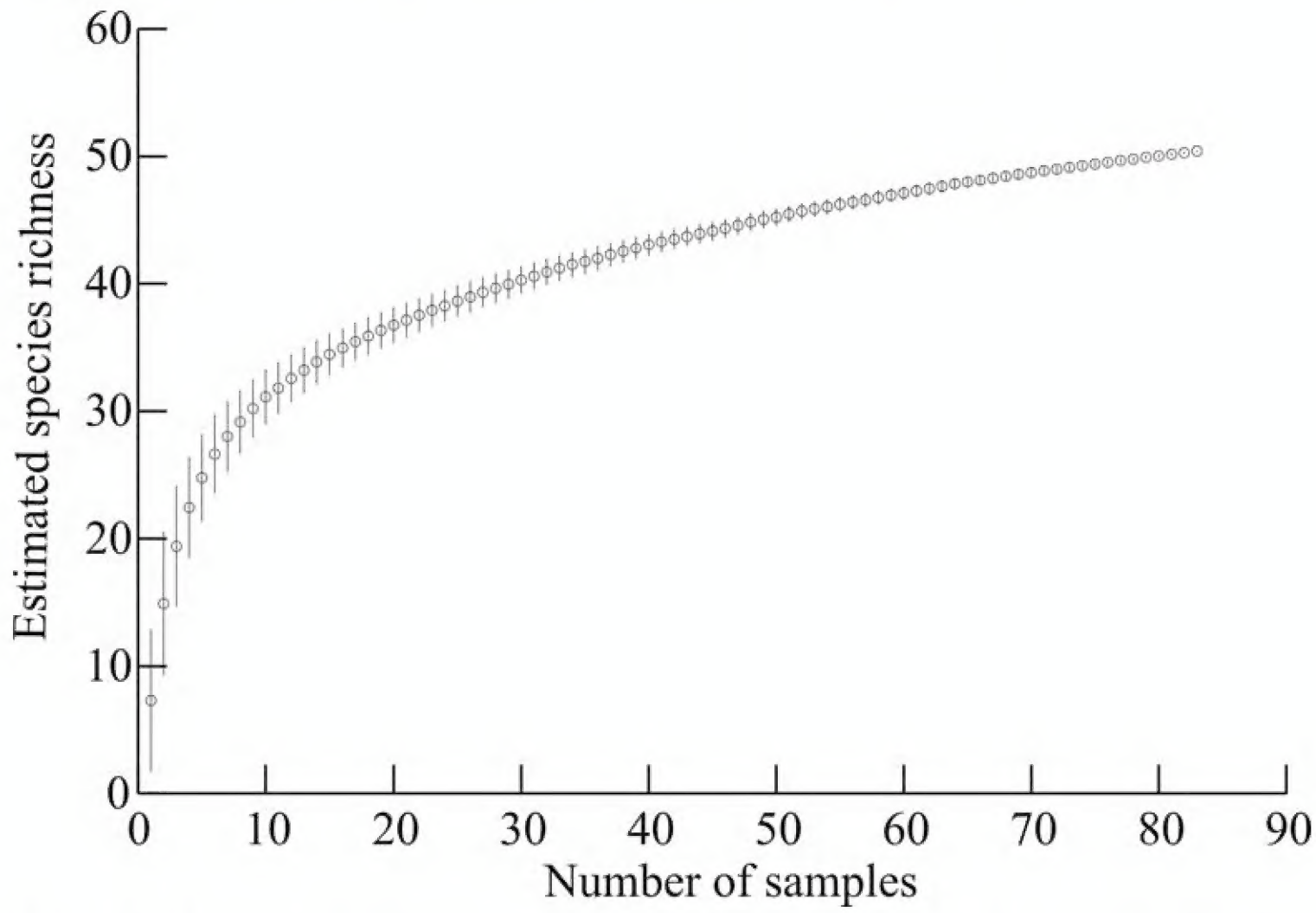

Figure 2. Estimated fish species richness and standard deviation for sampled streams in Ivinhema River basin using the bootstrap procedure.

Only three species occurred in all the sampled streams: *Astyanax altiparanae* Garutti & Britski, 2000, *Bryconamericus stramineus* Eigenmann, 1908, and *S. notomelas*. Fifteen species occurred in only one stream (exclusive species); Piravevê Stream had the greater number of species that occur exclusively in this site (six exclusive species), followed by Azul Stream (four species). Antonia and Da Mata streams contained no exclusive species (Table 1 and 2). Two explanations might account for these differences: (1) the sampling was more efficient in Azul and Da Mata streams, where even rare species were sampled; and (2) larger and deeper streams have fish communities composed by a greater number of rare species, which results in collecting a large number of species that occur only at these sites. The higher proportion of rare species in higher-volume streams may result from an increased migration rate, a result of environmental stability (Taylor and Warren 2001); this is usually accepted as an explanation of the "excess" of rare

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Table 1. Fish species sampled in streams of the Ivinhema River basin, state of Mato Grosso do Sul, from January to December 2002. L, Libório stream; A, Antonia stream; R, Rosário stream; V, Vitória stream; P, Piravevê stream; Az, Azul stream; and M, Da Mata stream.

Species List	Vitória basin				Piravevê basin		
	L	**A**	**R**	**V**	**P**	**Az**	**M**
Characiformes							
Acestrorhynchus lacustris (Lütken, 1875)					X		
Aphyocharax dentatus Eigenmann & Kennedy, 1903				X	X	X	
Astyanax altiparanae Garutti & Britski, 2000	X	X	X	X	X	X	X
Astyanax bockmanni Vari & Castro, 2007			X				
Astyanax sp. aff. *A. fasciatus* (Cuvier, 1819)	X	X	X		X		X
Astyanax paranae Eigenmann, 1914			X				X
Astyanax schubarti Britski, 1964						X	
Bryconamericus stramineus Eigenmann, 1908	X	X	X	X	X	X	X
Characidium cf. *zebra* Eigenmann, 1909	X	X	X	X	X		X
Characidium sp.					X		
Cyphocharax modestus (Fernández-Yépez, 1948)						X	
Hemigrammus marginatus Ellis, 1911			X		X	X	X
Hoplias malabaricus (Bloch, 1794)						X	
Hyphessobrycon eques (Steindachner, 1882)					X	X	
Leporinus friderici (Bloch, 1794)	X						
Moenkhausia sanctaefilomenae (Steindachner, 1907)				X	X	X	
Oligosarcus pintoi Campos, 1945		X	X	X	X	X	X
Piabina argentea Reinhardt, 1866	X	X		X		X	
Pyrrhulina australis Eigenmann & Kennedy, 1903		X	X	X	X	X	X
Roeboides paranensis Pignalberi, 1975					X	X	
Schizodon borellii (Boulenger, 1900)					X		
Serrapinnus notomelas (Eigenmann, 1915)	X	X	X	X	X	X	X
Serrapinnus sp.						X	
Serrasalmus marginatus Valenciennes, 1847					X		
Steindachnerina brevipinna (Eigenmann & Eigenmann, 1889)				X	X		
Siluriformes							
Corydoras aeneus (Gill, 1858)		X	X		X	X	X
Farlowella sp. aff. *F. amazona* (Günther, 1864)	X			X	X		
Hisonotus insperatus Britski & Garavelo, 2003	X			X			
Hisonotus sp.			X	X	X	X	
Hypostomus ancistroides (Ihering, 1911)	X	X		X	X	X	X
Hypostomus regani (Ihering, 1905)	X						
Imparfinis mirini Haseman, 1911	X						
Oxydoras eigenmanni Boulenger, 1895				X			
Phenacorhandia tenebrosa (Schubart, 1964)	X		X		X	X	X
Pimelodella gracilis (Valenciennes, 1835)	X				X	X	
Pseudopimelodus mangurus (Valenciennes, 1835)					X		
Rhamdia quelen (Quoy & Gaimard, 1824)	X			X		X	
Trachelyopterus galeatus (Linnaeus, 1766)				X	X		
Gymnotiformes							
Brachyhypopomus cf. *pinnicaudatus* (Hopkins et al, 1990)					X		
Eigenmannia trilineata Lopez & Castello, 1966			X		X	X	
Gymnotus sp.	X	X	X			X	X
Sternopygus macrurus (Schneider, 1801)	X		X	X	X	X	
Perciformes							
Cichlasoma paranaense Kullander, 1983			X	X	X	X	X
Crenicichla britskii Kullander, 1982	X		X	X	X	X	X
Cyprinodontiformes							
Phalloceros sp.		X	X	X	X		X
Rivulus pictus Costa, 1989			X				X

species in tropical communities (Magurran and Henderson 2003). Thus, some of the unique species observed in the streams, mainly in Piravevê Stream, may be occasional species. The bootstrap estimate suggested that 92 % of the total species richness was sampled during the study period. However, despite the predominance of small-sized species in stream communities (Castro 1999; Shibatta and Cheida 2003), the occurrence of larger species may be under-estimated, and additional samples using different fishing methods are necessary. At least two undescribed species, *Characidium* sp. and *Serrapinnus* sp., the latter equivalent to *Serrapinnus* sp 2 of Graça and Pavanelli (2007), were encountered in our samples, and four other species were not identified consistently, suggesting the need for increased sampling effort and taxonomic studies in streams of the Ivinhema and upper Paraná River basins.

Table 2. General characteristics of the ichthyofauna from seven streams in lower portions of the Ivinhema River basin, at upper Paraná River basin, in the state of Mato Grosso do Sul, Brazil from January to December 2002; NI, number of individuals.

Streams	Richness	NI	Dominant species	Exclusive species
Libório	18	113	*H. insperatus* *H. ancistroides* *P. argentea*	*H. regani* *L. friderici* *P. tenebrosa*
Antonia	12	149	*A. altiparanae* *A.* aff. *fasciatus* *C. aeneus*	-
Rosário	20	611	*B. stramineus* *H. marginatus* *S. notomelas*	*A. bockmanni*
Vitória	21	247	*Phalloceros* sp. *B. stramineus* *M. sanctaefilomenae*	*O. eigenmanni*
Piravevê	31	1184	*H. marginatus* *A. dentatus* *S. notomelas*	*P. mangurus* *A. lacustris* *B.* cf. *pinnicaudatus* *S. borellii* *Characidium* sp. *S. marginatus*
Azul	26	439	*S. notomelas* *H. marginatus* *A. dentatus*	*Serrapinnus* sp. *A schubarti* *C. modestus* *H. malabaricus*
Da Mata	17	640	*H. marginatus* *Phalloceros* sp. *C. aeneus*	-

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